II.9-FFG-OPER FLASH FLOOD GUIDANCE OPERATION

This section describes the Flash Flood Guidance Operation.

Parametric Data Requirements

The parametric data needed by the FFG Operation is maintained by the FCINIT program. The input for the rainfall-runoff relationships definition is specified in Section V.3.3-FFG. The parametric data is stored within a segment parameter array as described in Section VIII.3.3-FFG.

Output Requirements

The FFG parameter type for the PPPDB holds output from the FFG Operation.

The output from the FFG Operation includes rainfall-runoff relationships used to compute flash flood guidance and state variables used to update forecast models used in Local Flood Warning Sytems. The contents of the PPPDB data type FFG is specified in Section IX.4.3C-FFG.

Time Series Requirements

No output is held in time series form by the FFG operation.

Coding Specifications

Subroutines PIN32, PRP32, PUC32 and EX32 are required for this operation. PIN32 and EX32 are described in following sections.

Additional NWSRFS Requirements

1. MCP3, OPT3 and ESP calls to the FFG operation are not allowed.

2. Common block to store technique value. Common Block /FFGCTL/, variable IFFG. The technique and thus IFFG can have 3 values:

   0 = no FFG calculations. Do not call FFG subroutine.

   1 = FFG only run. Operations after the last FFG operation in a segment do not have to be executed; carryover should not be saved; and no time series need to be written to the PDB.

   2 = both FFG and regular forecast run.

   ENDRUN must be at least 24 hours beyond LSTCMPDY for a FFG run if temperature data are needed (i.e. if API-CIN operation included; if API-CONT operation using ATI included; if technique SNOW is on and SNOW-17 operation included; or if technique FROST is on and a SAC-SMA or API-CONT operation using the frozen ground option is included). Otherwise, ENDRUN can be as soon after LSTCMPDY as possible. The value of IFFG should be set to 0 for the IFP program.

3. For some rainfall-runoff models the runoff calculation algorithms are in separate subroutines so they can be used by both the rainfall-runoff model and the FFG operation. Operations affected are: API-CIN, API-HAR, API-HFD and API-MKC.

4. For snow and rainfall-runoff operations when the EX routine is exited, the C array contains carryover for the date closest to LSTCMPDY when the FFG technique is equal to 1 or 2. Operations affected are: API-CIN, API-HAR, API-HFD, API-MKC, API-CONT, SNOW-17 and SAC-SMA. The closest date is defined as the computational time interval equal to or just before LSTCMPDY. This will insure no QPF is included in carryover to be used by the FFG operation.

EX32 Subroutine

The execution sequence for the EX32 subroutine is shown in Figure 1 and described as follows:

1. Get operation name and type of the snow model.

2. Get operation name and type of the rainfall-runoff model.

3. Get carryover and parameters for snow model. Passed in argument list.

4. Get carryover and parameters for rainfall-runoff model. Passed in argument list.

5. Compute runoff using the snow and rainfall-runoff models for four values of rainfall for each duration. The first rainfall should be the current storm total rain because all FFG calculations will be greater and never less than this value. The other three rainfalls should provide a workable range for the threshold runoffs defined in the Flash Flood Guidance System (FFGS).

   In the FFEXEC program component of FFGS, threshold runoff must be added to the storm total runoff to give a new storm total runoff. Next, compute the new storm total rain required to produce the new storm total runoff using the rainfall-runoff model. Then the new storm total rain minus the old storm total rain is the FFG. The equations are:

   $$SRO_0 + TRO = SRO$$

   $$f(AI, SRO) = SRA \quad \text{from API model}$$

   $$SRA - SRA_0 = FFG$$

   where SRO_0 = storm total runoff from state variables
   SRA_0 = storm total rain from state variables
   SRO = new storm total runoff
   SRA = new storm total rain
   TRO = threshold runoff

   A typical rainfall-runoff curve is shown in Figure 1.

6. Using subroutine RPPREC and the FFG area ID, get the data type FFG parameter record from the PPPDB.

7. Using subroutine WPPREC write (1) LSTCMPDY, (2) the four rainfall-runoff points for each duration, and (3) the rainfall-runoff model state variables back to the same record in the PPPDB as read in item 6.

PIN32 Subroutine

The execution sequence for the PIN32 subroutine is shown in Figure 2 and described as follows:

1. Check that the snow operation type and name have been defined in the segment.

2. Check that the rainfall-runoff operation type and name have been defined in the segment.

3. Check that the basin boundary exists and get the lat and lon of the basin centroid from the basin boundary definition.

4. Check that MAP or MAPX associated with the basin identifier is the same as used by the snow operation or the rainfall-runoff operation if snow not used.

5. Using subroutine WPPREC and the type code FFG, write the FFG area ID, description, basin boundary ID, centroid, operation type and name for the snow model, operation type and name for the rainfall-runoff model to the PPPDB. Additional space is required in each record to store the current date and time, rainfall-runoff relations and state variables during execution of the EX32 subroutine. The size of the record is fixed because it will be read and rewritten numerous times.

Figure 1. Executing Flash Flood Guidance Operation in OFS Routine FCEX32

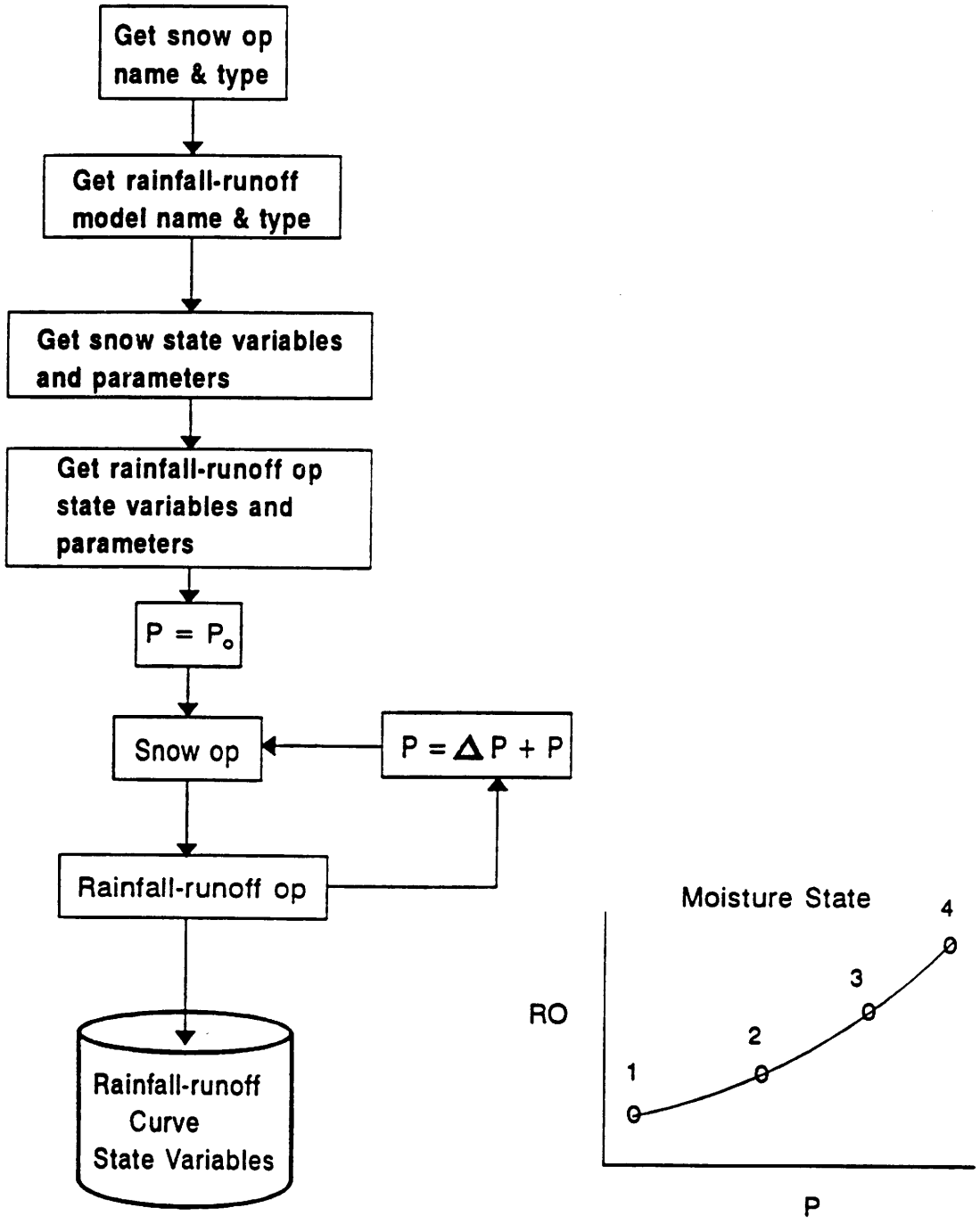

Figure 2. Defining Flash Flood Guidance Operation in OFS Routine PIN32